Canadian Aviation Safety Board

Bureau canadien de la sécurité aérienne

# Civil Aviation Occurrence Report

Canada

The Canadian Aviation Safety Board investigated this occurrence for the purpose of advancing aviation safety. It is not the object of the Board to determine or apportion any blame or liability.

AVIATION OCCURRENCE REPORT

PIPER PA-32-260 CHEROKEE SIX C-FGKN
LAKE KEMPT, QUEBEC 7 mi SE
14 JUNE 1987

REPORT NUMBER 87-Q70018

## SYNOPSIS

The aircraft, with six persons aboard, departed Reservoir Gouin, Quebec, following a fishing expedition, on a visual flight rules flight to Mascouche Airport, Quebec. The following morning, the aircraft was reported missing. It was found by Search and Rescue on the same day, 68 nautical miles from its point of departure, on track. All persons aboard sustained fatal injuries in the crash.

The Canadian Aviation Safety Board determined that the pilot was not aware of the extent and severity of the en-route thunderstorm activity. He continued flight into severe adverse weather conditions and lost control of the aircraft.

Ce rapport est également disponible en français.

13 December 1988

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## 1.0 FACTUAL INFORMATION

### 1.1 History of the Flight

On June 14, the aircraft, a Piper PA-32-260 Cherokee Six, registration C-FGKN, departed Reservoir Gouin, Quebec, at 1830 eastern daylight time (EDT)* for a visual flight rules (VFR)** flight to Mascouche Airport, Quebec (see Appendix A). No flight plan was filed; however, several acquaintances of the pilot were aware of the departure time and approximate estimated time of arrival in Mascouche. On board were the pilot and five passengers. At approximately 1900 EDT, the pilot contacted other flights in the area and inquired about the en-route weather. At that time, he reported flying at 1,100 feet above ground level (agl)***, just north of Lake Kempt. There were no other radio transmissions.

On the morning of 15 June, the aircraft was reported missing by one of the pilot's friends. A search operation was initiated, and the aircraft was located the same day, 68 nautical miles from its point of departure, (just south of Lake Kempt), exactly on track. All persons aboard were killed in the crash.

The accident occurred at lat 47°21'N, long 74°07'W, at an elevation of approximately 1,700 feet above sea level (asl). Based on the aircraft's cruise speed versus the distance flown, it was estimated that the aircraft crashed at approximately 1915 EDT during the hours of daylight.

### 1.2 Injuries to Persons

| | Crew | Passengers | Others | Total |
|---|---|---|---|---|
| Fatal | 1 | 5 | - | 6 |
| Serious | - | - | - | - |
| Minor/None | - | - | - | - |
| Total | 1 | 5 | - | 6 |

* All times are EDT (Coordinated Universal Time (UTC) minus four hours) unless otherwise stated.

** See Glossary for all abbreviations and acronyms.

*** Units are consistent with official manuals, documents, reports, and instructions used by or issued to the crew.

## 1.3 Damage to Aircraft

The aircraft was destroyed.

## 1.4 Other Damage

During the investigation, an area of 2,000 square feet was cleared of trees in order to recover the wreckage. The accident occurred on crown property.

## 1.5 Personnel Information

| | Pilot-In-Command |
|---|---|
| Age | 45 |
| Pilot Licence | Private |
| Medical Expiry Date | 01/08/87 |
| Total Flying Time | 456 hr |
| Total on Type | 22 hr |
| Total Last 90 Days | 27 hr |
| Total on Type Last 90 days | 22 hr |
| Hours on Duty Prior to Occurrence | 2 hr |
| Hours off Duty Prior to Work Period | 70 hr |

The pilot was familiar with the area and had flown similar trips a number of times. Although he had accumulated only five hours of simulated instrument training, he had practised instrument flying in actual conditions with one of his friends and had demonstrated ability to keep the wings level while in instrument meteorological conditions (IMC). The aircraft's LORAN C was used to navigate during these exercises. The pilot had not received any formal instrument training toward an instrument flight rules (IFR) rating.

The passenger occupying the right front seat had no pilot flying experience.

## 1.6 Aircraft Information

| | |
|---|---|
| Manufacturer | Piper Aircraft Corp. |
| Type | PA-32-260 Cherokee Six |
| Year of Manufacture | 1967 |
| Serial Number | 32-898 |
| Certificate of Airworthiness | Valid |
| Total Airframe Time | 1,690 hr |
| Engine Type | Lycoming 0-540-E4B5 |
| Maximum Allowable Take-off Weight | 3,400 lb |
| Recommended Fuel Type | 100/130 |

Examination of the aircraft records determined that a required inspection of the control yokes had not been made in accordance with the schedule specified by Airworthiness Directive (AD) 69-22-2. This inspection was required to detect possible cracking of the control yoke in the area of the centre hub. The inspection requirement was repetitive at 100-flight-hour intervals. At the time of the accident, the required inspection interval had been exceeded by 13.15 hours. The inspection had been carried out on previous occasions in accordance with the specified schedule, and, in each case, the yokes were found to be free of cracks.

The aircraft weight and centre of gravity were within the prescribed limits.

## 1.7 Meteorological Information

### 1.7.1 General

The area was under the influence of a frontal wave situated to the west of Matagami at 1400 EDT, moving in a southeasterly direction to be in the vicinity of Quebec City at 0200 EDT, 15 June. Associated with this wave were a warm front extending in a southeasterly direction and a cold front extending in a westerly direction.

### 1.7.2 Forecast Weather

The area forecast for the Montreal, Eastern Townships, Val d'Or, Laurentian, Saguenay, Quebec City, and Sept Iles Regions issued at 1330 EDT, 14 June and valid for the period 1400 EDT, 14 June to 0200 EDT, 15 June predicted scattered, variable broken clouds at 3,000 to 4,000 feet asl topped at 8,000 feet asl, and broken, variable overcast clouds at 9,000 feet asl topped at 18,000 feet asl in the area ahead of the warm front. Also forecast for the area ahead of the warm front were embedded towering cumulus clouds giving visibilities four to six miles in light rain showers, and isolated cumulo-nimbus cloud to 25,000 feet asl giving visibilities three to five miles in thunderstorms and light rain showers with local ceilings 400 to 800 feet agl. In the vicinity of the warm front, there was a risk of cumulo-nimbus cloud to 40,000 feet asl giving visibilities one to three miles in moderate thunder and rain showers with surface winds gusting to 40 knots. Moderate to severe turbulence was forecast in the vicinity of the front and the cumulo-nimbus cloud.

No terminal forecasts are issued for the immediate vicinity of the accident site. The terminal forecast for Chibougamau, approximately 75 miles northeast of Reservoir Gouin, issued at 1230 EDT and valid for the period 1300 EDT, 14 June to 0100 EDT, 15 June was as follows:

> 2,500 ft scattered, ceiling 10,000 ft overcast; wind 210° T at 15 kt; occasional ceiling 2,000 ft broken, 8,000 ft overcast; visibility 4 mi in light rain showers and light thunder showers after 1500; risk of visibility 2 mi in heavy thunder showers with wind gusting to 35 kt after 1700 EDT; wind 260° T at 15 gusting to 25 kt after 1900 EDT; 2100 EDT - 2,500 ft scattered; wind 280° T at 15 kt; occasional ceiling 2,500 ft broken.

An amendment to the Chibougamau terminal forecast, issued at 1455 EDT and valid for the period 1500 EDT, 14 June to 0100 EDT, 15 June was as follows:

> 2,500 ft scattered, ceiling 10,000 ft overcast; wind 210° T at 15 gusting to 25 kt; occasional ceiling 2,000 ft broken, 8,000 overcast; visibility 4 mi in light rain showers and light thunder showers; risk of visibility 2 mi in heavy thunder showers with wind gusting to 35 kt; wind 260° T at 15 gusting to 25 kt after 1900 EDT; 2100 EDT - 2,500 ft scattered; wind 280° T at 15 kt; occasional ceiling 2,500 ft broken.

The terminal forecast for Montreal Dorval, 15 miles west of Mascouche, issued at 1230 EDT and valid for the period 1300 EDT, 14 June to 0200 EDT, 15 June was as follows:

> 3,000 ft scattered, 10,000 ft scattered; occasional ceiling 3,000 ft broken, 10,000 ft broken; risk of light thunder showers after 1800 EDT.

### 1.7.3 Actual Weather Conditions

No surface observations are taken in the vicinity of the accident site. However, actual conditions at the time of the accident were determined through examination of satellite photographs, weather radar observations, the 2000 EDT, 14 June tephigram from Maniwaki, and hourly surface weather observations taken at locations surrounding the accident site.

General conditions consisted of a layer of scattered to broken cumulus and strato-cumulus cloud at 5,000 to 6,000 feet asl topped at 8,000 feet asl, and a layer of

scattered to broken alto-cumulus cloud at 9,000 to 10,000 feet asl topped at 12,000 feet asl. Associated with these layers were embedded towering cumulus clouds topped at 19,000 feet asl, giving light to moderate rain showers with visibilities from two to eight miles. Also present were cumulo-nimbus clouds to 30,000 feet asl, giving light to moderate thunder showers, reducing visibility to between one and a half and eight miles and causing local stratus ceilings between 700 and 1,000 feet agl and winds gusting from 20 to 40 knots. Severe turbulence and icing were associated with the cumulo-nimbus cloud and thunderstorm activity.

A satellite photograph taken at 1903 EDT and radar echoes from the Quebec City weather radar at 1920 EDT showed a line of thunderstorms oriented northeast to southwest in the area of the accident site.

Several pilot reports of weather conditions were obtained from pilots who were flying in the vicinity of the accident site on the afternoon of 14 June. Those reports confirmed the existence of extensive vertical development cloud and associated heavy rain, reduced visibility, and turbulence. One pilot, en route from Drummondville to Parent, reported IFR conditions in heavy rain and turbulence between Lac Mondonac (approximately 10 miles east of the accident site) and Lac Dandurand (approximately 30 miles north of the accident site) at about 1800 EDT. Another pilot departed Barrage Gouin for La Tuque at 1535 EDT. He reported a line of thunderstorms to the northwest moving slowly toward the southeast. A third pilot, ahead of the accident aircraft and on a parallel route, reported rain between Parent and Lac Kempt. He reported seeing severe thunderstorms although they were difficult to see due to haze. A short time later, this same pilot returned to his point of departure, passing to the west of Lac Kempt. The thunderstorms he had seen were in the immediate vicinity of Lac Kempt. He reported a line of thunderstorms about 30 miles long, with heavy rain.

### 1.7.4 Weather Information Obtained by the Pilot

There was no record that the pilot had checked the aviation forecasts for either en-route or destination weather prior to departure. Such information was available by telephone from any flight service station (FSS). There was witness testimony that the pilot was made aware that the latest weather for the Montreal area was suitable for visual flight and that thunderstorms were forecast by late afternoon in the general area of Reservoir Gouin.

Once airborne, the pilot requested the actual weather for St-Michel-des-Saints and Montreal on 122.9 megahertz (MHz) (air to air frequency). A pilot ahead of him, flying on a parallel route, told him that the conditions were VFR for the two requested points but warned him of an oncoming front and of associated thunder showers. The pilot of the accident aircraft replied that he had Lake Kempt in sight and that he was VFR at 2,800 feet asl (1,100 feet agl).

## 1.8 Aids to Navigation

In addition to the basic flight instruments required for IFR flight, the aircraft was equipped with a LORAN C. The instrument panel and radios were severely damaged, making it impossible to determine which frequencies had been selected.

## 1.9 Communications

The only radio communication was the one established with the other pilot regarding the en-route weather.

## 1.10 Aerodrome Information

The pilot overflew the Parent and Kanawata airports shortly before the accident. These airports are located within 40 nautical miles of the accident site and were suitable for landing.

## 1.11 Flight Recorders

The aircraft was not equipped with a flight data recorder or a cockpit voice recorder, nor was either required by regulation.

## 1.12 Wreckage and Impact Information

### 1.12.1 Accident Site

The accident site was in a wooded area. The general area was relatively flat, with medium to tall trees. Broken tree-tops and ground imprints indicated that the aircraft struck the ground at high speed while in a steep nose-down, right-wing-low attitude, at a measured angle of 60 degrees, on a magnetic heading of 318 degrees (see Appendix B). The right wing left an imprint 16 feet from

the broken trees, and the engine and fuselage created a three-foot-deep crater, 37 feet from the initial tree contacts. The aircraft bounced ahead, ploughing and uprooting seven trees, finally coming to rest after travelling a further 17 feet.

From beginning to end, including objects that were flung out, the wreckage trail measured 113 feet, with the greatest concentration of the wreckage found at the 54-foot mark.

### 1.12.2 Aircraft Wreckage

The right wing was completely separated from the aircraft and had broken into two major pieces. The right wing outboard panel was severed at tree contact, and total wing separation occurred at ground impact. The left wing inner-half portion remained attached to the fuselage. The outer portion was sectioned by trees. The rear fuselage was broken just aft of the baggage compartment door, but it remained connected to the centre section by the empennage control cables.

Following an initial examination at the accident site, the wreckage was recovered and transported to Montreal for detailed examination.

All flight control cables and control surfaces were accounted for. There were no observed failures of any of the flight control cables, except for the right wing front aileron cable which had failed as a result of the wing breakup at impact.

Examination of the disassembled engine did not reveal any mechanical discrepancies with any of the cylinders, pistons, piston rings, valves, rocker arms, crankshaft, and connecting rods. Most push rods were intact; however, several were bent from impact. There was no evidence of mechanical distress or lack of lubrication throughout the engine. The deformation sustained by the propeller blades and the sheared propeller mounting flange was consistent with engine operation at a relatively high power setting. This was further substantiated by the large quantity of soil and moisture ingested by the engine prior to complete stoppage.

An exhaustive and detailed examination of the powerplant, airframe structure, and systems failed to reveal any evidence of pre-impact mechanical malfunction. All of the damage sustained or failures noted were the result of tree and ground impact.

Only one of the two control yokes was recovered from the wreckage. The installed position of the recovered yoke could not be determined. There was no evidence of pre-impact failure or cracking. The centre hub area was intact and still riveted to its shaft. However, it was broken at the handgrips, suggesting that it was being held at the time of impact.

## 1.13 Medical Information

All occupants of the aircraft sustained multiple fatal injuries on impact. There was no evidence that incapacitation, physiological, or psychological factors affected the pilot's performance.

## 1.14 Fire

There was no evidence of fire before or after the occurrence.

## 1.15 Survival Aspects

This accident was non-survivable due to the magnitude of the deceleration forces.

### 1.15.1 Seat-Belts/Restraints

None of the seats remained attached to the seat rails; most were thrown clear of the aircraft. None of the seat-belts remained intact, and indications are that they were used. All seat-belts exhibited failures caused by high deceleration forces that exceeded the design capability of the seat-belts.

### 1.15.2 Emergency Locator Transmitter (ELT)

The emergency locator transmitter (ELT) was armed and triggered at impact. However, because the antenna broke off at the case knot connector during breakup, signal strength was severely reduced. Although it could not be picked up by the Search and Rescue Satellite (SARSAT), it was nevertheless effective at short range and was instrumental in the location of the aircraft by search aircraft.

## 1.16 Tests and Research

### 1.16.1 Fuel

No fuel samples were available at the accident site due to impact damage; however, fuel samples were taken from the last two refuelling points and were found to meet applicable standards.

### 1.16.2 Instruments and Gyros

The instrument panel remnants were forwarded to the CASB Engineering Laboratory in Ottawa for detailed examination. Impact readings of the recovered engine instruments were consistent with engine operation at a cruise power setting. There was no indication of any engine malfunction. Two air-driven gyros, which had been ejected from their respective instrument casing, showed evidence of rotation at ground impact.

### 1.16.3 Propeller

The propeller was forwarded to the CASB Engineering Laboratory in Ottawa for detailed examination. This examination determined that the crankshaft/mounting flange had failed in overload and that the propeller blade was at approximately 20 degrees at the time of impact. The damage sustained was consistent with engine operation at a relatively high power setting.

## 1.17 Additional Information

Not applicable.

## 2.0 ANALYSIS

### 2.1 Introduction

The aircraft struck the ground in a near-vertical descent at high speed, indicating that the pilot had lost control of the aircraft. The analysis focuses on the pre-impact condition of the aircraft, the weather conditions encountered during the flight, and the actions and decisions of the pilot.

### 2.2 Aircraft Condition

There was no evidence of any aircraft structural failure prior to impact with the terrain. All flight control surfaces were accounted for, and all observed damage to the aircraft was assessed to be the result of impact. Damage to the engine and propeller was consistent with engine operation at a cruise power setting.

Since one of two control yokes was not recovered from the wreckage, it was not possible to establish its pre-impact condition. However, the Board considers it unlikely that problems with the control yoke figured in the sequence of events that led up to the loss of control. Although the required inspection interval had been exceeded, it had only been exceeded by a small amount. Cracking of the control yoke had not been detected on previous inspections, and it is extremely unlikely that, in the period following the last inspection, cracking could have started and propagated to the extent that an in-flight failure of the yoke could have occurred. The recovered yoke showed no evidence of cracking. It was, however, broken at the handgrips, suggesting that it was the pilot's yoke and was being held at the time of impact.

### 2.3 Weather Factors

Satellite photographs, radar reports, and pilot reports all indicate that the weather conditions associated with the warm front were in the immediate vicinity of the accident site at the time of the accident. Thus, although it is impossible to establish with certainty the sequence of events that immediately preceded the loss of control, it is clear that it occurred at about the time the aircraft was in the vicinity of a line of thunderstorms which lay across the route of flight.

It is not known if the aircraft entered instrument meteorological conditions, however, it is a distinct possibility. Weather conditions associated with the frontal thunderstorms were characterized by visibilities of about one mile and ceilings below 1,000 feet agl. Although the pilot was reported to have flown in instrument conditions on previous occasions, he was not instrument trained or rated, and the associated turbulence would have posed significant control problems for the pilot. Without the benefit of proper training and experience in instrument flight, there would also be a high potential for spatial disorientation in these conditions. Also, the turbulence associated with the thunderstorms may have been beyond the pilot's or the aircraft's capabilities, leading to a loss of control.

## 2.4 Pilot Actions and Decisions

Weather conditions along the route of flight were consistent with the forecast weather available to the pilot prior to departure from Reservoir Gouin. The area forecast for the southern half of the Province of Quebec and terminal forecasts applicable to airports near the point of departure and destination all predicted a risk of thunder shower activity in the vicinity of the warm front which was to pass over the area along the route of flight on the afternoon of 14 June.

Prior to departure, the pilot did not obtain the available weather forecasts. Although the terminal forecasts in the surrounding area of the route to be flown did not indicate that conditions would be below those required for VFR flight (clear of cloud and one mile flight visibility), the area forecast made mention that local marginal VFR conditions could be anticipated. The pilot, once airborne, obtained actual weather conditions for St-Michel-des-Saints and Montreal and obtained a pilot report from an aircraft in the vicinity which warned of thunder showers in the area. Although he was aware of the possibility of thunderstorm activity, he would not have been aware of the intensity, extent, and effects of the weather associated with the front.

The accident site was on the direct track between the departure and destination airports. Two aerodromes suitable for a landing were overflown by the pilot only minutes before the accident. When the weather conditions associated with the front were encountered, the pilot did not return to his point of departure, divert to another aerodrome, or deviate around the storm cells.

The Board believes that the pilot underestimated the intensity and effects of the weather associated with the front and continued flight into deteriorating weather. When he encountered conditions beyond his or his aircraft's capabilities, he was unable to maintain control.

## 3.0 CONCLUSIONS

### 3.1 Findings

1. Weather conditions along the route of flight were influenced by the passage of a warm front with associated moderate thunder shower activity, low ceilings, reduced visibilities, and severe turbulence.

2. A line of thunderstorms lay across the intended route of flight at about the time of the accident.

3. Prior to initiating the flight, the pilot did not obtain the available weather forecasts.

4. The pilot continued flight into an area of thunderstorms and associated low ceilings, reduced visibilities, and severe turbulence.

5. The pilot was certified and qualified for flight under visual flight rules but was neither certified nor qualified for flight in instrument meteorological conditions.

6. The pilot lost control of the aircraft when he encountered severe adverse weather conditions.

7. With the exception of Airworthiness Directive AD 69-22-2 which had not been accomplished in accordance with the specified time interval, the aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures.

8. There was no evidence found of any airframe failure or system malfunction prior to or during the flight.

9. There was no evidence of fire before or after the occurrence.

10. The weight and centre of gravity were calculated to be within the prescribed limits.

### 3.2 Causes

The pilot was not aware of the extent and severity of the en-route thunderstorm activity. He continued flight into severe adverse weather conditions and lost control of the aircraft.

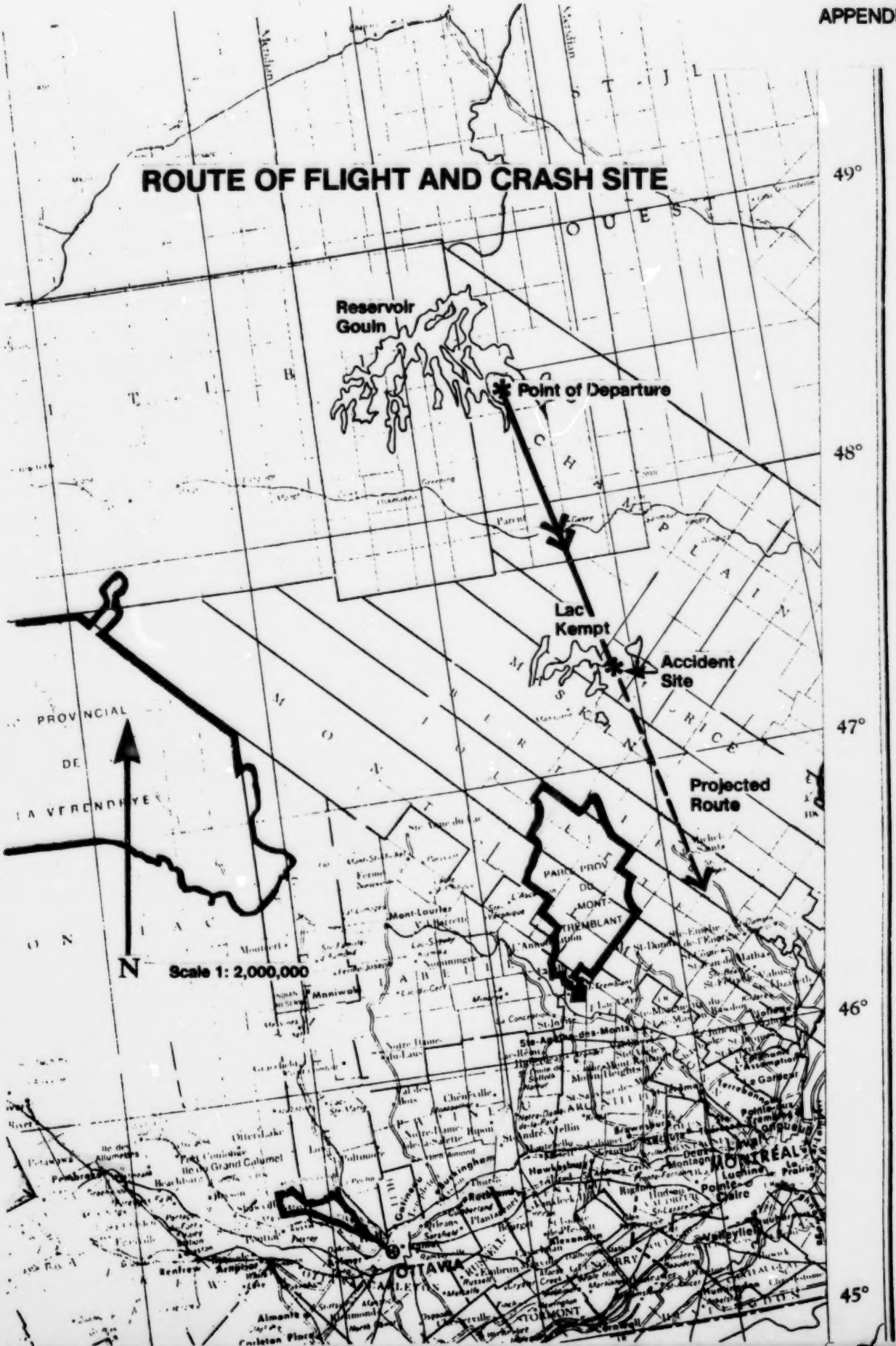
## 4.0 SAFETY ACTION

### 4.1 Safety Concerns

The Board is concerned over the frequency with which pilots continue VFR flights into adverse weather with fatal results. Thus, the Board is currently conducting a major safety study of approximately 350 accident files where VFR flight was continued into IFR conditions. Inter alia, this study will analyse the typical profiles of the accident pilots and aircraft equipment along with the operating conditions extant at the time of the accidents. An analysis of Canadian regulatory requirements for the conduct of such flights vis-à-vis current operating practices will also be made. In particular, the study will address potential safety deficiencies with respect to the Canadian system for obtaining and maintaining an instrument rating. It is anticipated that this study will result in several major recommendations aimed at reducing the frequency of this type of accident.

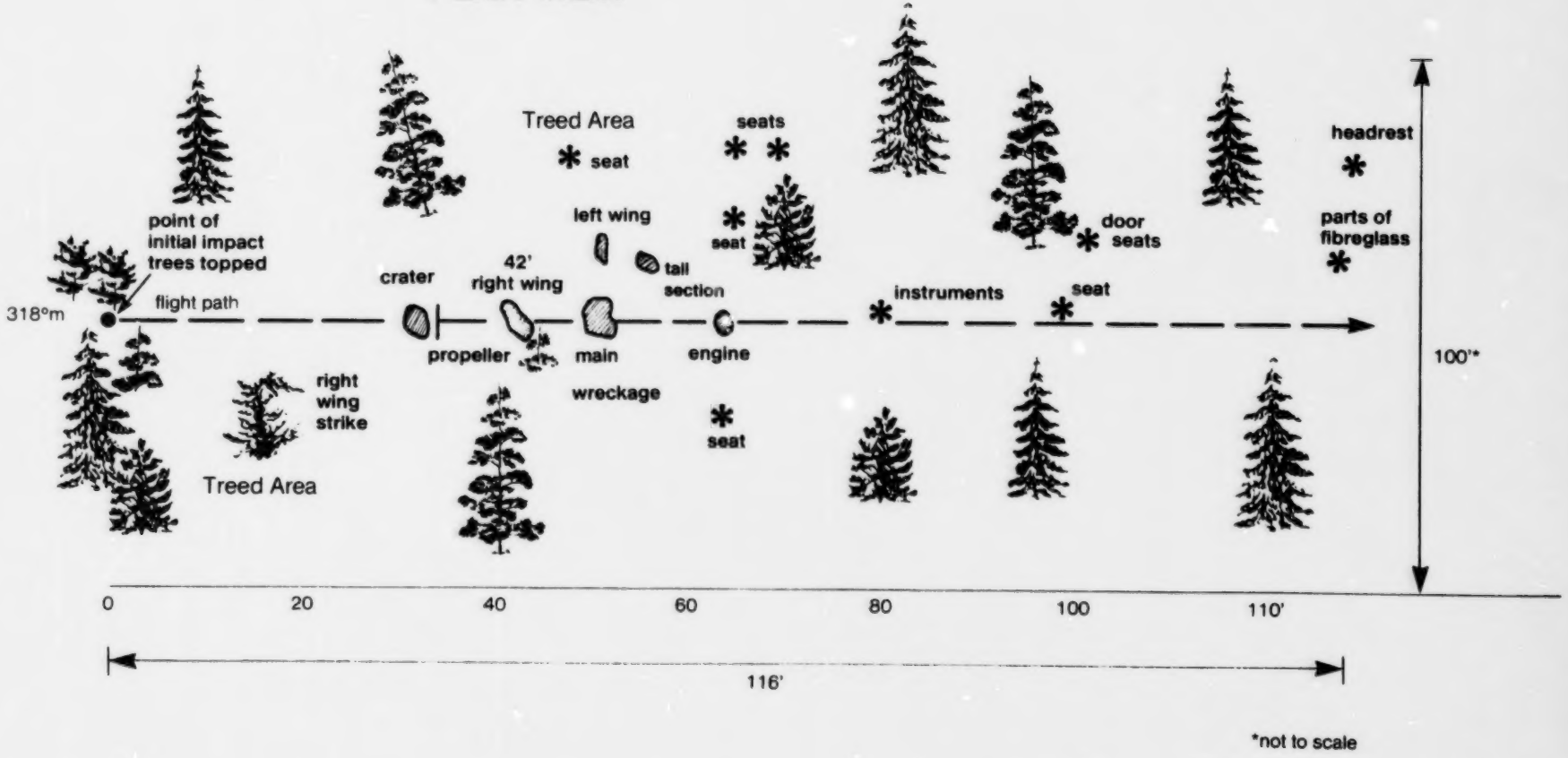
This report and the safety action therein has been adopted by the Chairman, K.J. Thorneycroft, and Board Members:

N. Bobbitt
L. Filotas
W. MacEachern
D. Mussallem
B. Pultz
F. Thurston


ROUTE OF FLIGHT AND CRASH SITE
Reservoir Gouin
Point of Departure
Lac Kempt
Accident Site
Projected Route
N
Scale 1: 2,000,000
49°
48°
47°
46°
45°
OTTAWA
MONTRÉAL

APPENDIX B

# WRECKAGE DISTRIBUTION
# PLAN VIEW




*not to scale

APPENDIX C

## LIST OF LABORATORY REPORTS

The following laboratory reports were completed:

LP 138/87 - Instrument Analysis
LP 141/87 - Propeller Failure Analysis

These reports are available upon request from the Canadian Aviation Safety Board.

APPENDIX D

## GLOSSARY

| | |
|---|---|
| agl | above ground level |
| asl | above sea level |
| EDT | eastern daylight time |
| FSS | flight service station |
| hr | hour(s) |
| IFR | instrument flight rules |
| IMC | instrument meteorological conditions |
| lat | latitude |
| lb | pound(s) |
| long | longitude |
| M | magnetic |
| MHz | megahertz |
| N | north |
| SARSAT | Search and Rescue Satellite |
| VFR | visual flight rules |
| VMC | visual meteorological conditions |
| W | west |
| ° | degree(s) |
| ' | minute(s) |